Three Dimensional Integrated Characterization and Archiving System (3D-ICAS)

Developer: Coleman Research Corporation
Contract Number: DE-AC21-93MC30176
Crosscutting Area: Robotics

Deactivation & Decommissioning FOCUS AREA

Problem:

Characterization sampling and analysis for hazardous organic and radionuclide contamination on concrete, asbestos, and transite is a time-consuming, expensive process with the potential of exposing humans to radiation and hazardous materials. Waste is generated in the form of protective garments/equipment and time requirements are increased because of exposure limits, rest breaks, and donning and removal of protective garments/equipment. Additional costs are incurred for handling and transporting potentially hazardous materials. Off-site laboratory analysis is expensive and time-consuming, often necessitating delay of further activities until results are received.

Solution:

Develop a remote system to characterize facilities for decontamination and decommissioning (D&D) that can perform rapid in situ analysis of hazardous organics and radionuclide contamination on structural materials.

Benefits:

▸Improved Performance: The quality of analytical data generated by 3D-ICAS chemical analysis instrumentation will equal or exceed that currently being generated by conventional laboratories. Sample automation and elimination of the extensive sampling handling associated with off-site storage and analysis will improve the reliability of the data as well as significantly reduce sample preparation time.

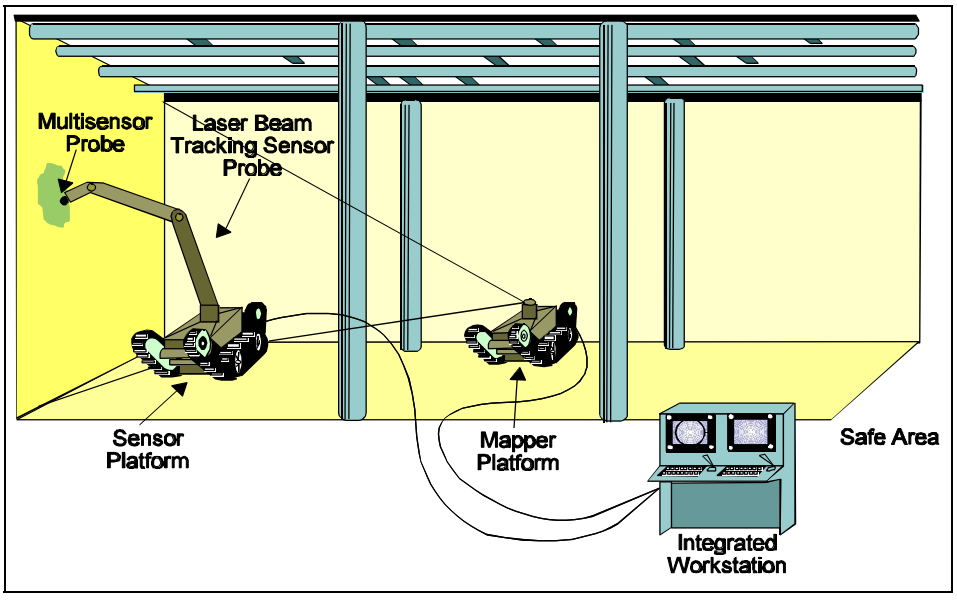
▸Cost Reduction: Costs for chemical analysis will be reduced because the whole process from sample preparation to data management can be automated and performed on-site.

▸Reduction of Health Risks: The automation of sample preparation steps and actual site mapping will eliminate sample handling by laboratory personnel.

▸Reduction of Environmental Risks: Using real-time analysis engineers could monitor and respond to problems in less time than is possible with conventional chemical analysis.

▸Improved Operations: The robot operated analysis instrumentation will improve the capabilities of the Department of Energy (DOE) response in each of the three phases of remedial efforts by providing a more efficient, streamlined beginning-to-end operational capability.

▸Waste Minimization: Procedures



can be halted as soon as compliance is achieved, preventing excess of removal of otherwise clean material. More detailed mapping and characterization of the site will identify areas that are in compliance and do not require decontamination.

Technology:

The configuration consists of a mobile sensor platform and a mobile mapper platform that operate in contaminated areas, and an integrated workstation that remains in a safe location. During characterization operations the mapper, using its coherent laser radar (CLR), maintains its precise location and reports the positioning of a multi-sensor probe located on a robotic arm extending from the sensor platform. The operator at the integrated workstation, using displayed 3D map information, plans and directs the selection of surface areas to be characterized and the number of samples for a given area. The 3D-ICAS then automatically samples these areas; archives 3D location, time, and concentrations of each contaminant; and provides map displays at the workstation showing contoured contaminated regions.

The permanent measurement data archiving allows easy regulatory review of the characterization process and assures data integrity. The dense, uniform surface sampling allows the straightforward establishment of the contour bounds of regions exceeding regulatory limits.

CLR provides topographical mapping and position references for the chemical and radionuclide information. Molecular Vibrational Spectroscopy (MVS) is used to characterize the type of substrate material and to measure toxic organics down to the low parts per million level. High speed gas chromatography/mass spectrometry (GC/MS) with thermal desorption provides definitive measurement of polychlorinated biphenyls and other toxic organics down to the low parts per billion level.

Alpha and beta counting with energy discrimination is used to identify and quantify isotopes of uranium, plutonium, thorium, technetium, neptunium, and americium.

Remote CLR mapping is done using a scanner unit mounted on the mapper platform. Close-in sensing is done using a multisensor head mounted on a robotic arm deployed from the sensor platform. The multisensor probe is designed to carry all of its sensor components, or a selected subset, depending on the characterization mission.

The subcomponents are being integrated and the system will be tested at the Oak Ridge National laboratory (ORNL) during the summer of 1997.

Contacts:

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